Patent Claims

1. A method of reading passive tags (11) in a radio-frequency identification system, in which an interrogating station comprising an antenna array (10, 10a....10n) sends radio-frequency inquiry signals towards passive tags (11) to be identified, and each tag (11) associates information stored thereon with the received inquiry signal to form a response signal that is reflected towards the interrogating station and is processed therein, characterised in that an absolute value and a phase of each response signal received at each antenna (10a....10n) in the array are detected at the interrogating station, each received response signal is submitted to phase conjugation thereby generating a respective phase-conjugated signal, and the phase conjugated signals are transmitted back to the passive tags (11).

2. The method according to claim 1, characterised in that an amplification of the signals to be transmitted back to the passive tags (11) is performed at the interrogating station.

3. The method according to any of claims 1-2, characterised in that the inquiry signal is a wide angle lobed signal.

4. The method according to any of claims 1 to 2, characterised in that, for said tag tracking, after the back transmission of a phase conjugated signal to a tag (11), a new response from the tag (11) is waited for by the interrogating station, each new response signal is correlated with the previous one and the operations of phase conjugation of the response signal, back-transmission of the phase-conjugated signal, reception of a new response signal, and correlation of each new response signal with the previous one are iteratively performed until the correlation reveals that the tag (11) is stationary.

5. The method according to claim 4, characterised in that, after detection of the stationary condition of a tag (11), the absolute value and the phase of the last received response signal are stored at the interrogating station to mark a steady tag position, and a check is performed on whether the stationary condition is maintained by periodically sending back to the tag (11) the phase-conjugated signal relative to the stored position, the cycle of tag tracking being resumed whenever the tag response during the check of the stationary condition reveals a position variation

6. The method according to claim 5, characterised in that, in case the phase-conjugated signal periodically sent back to a tag (11) fails to reach the tag (11), a search for the tag (11) is effected by means of a spatial scanning of a space in which the tag (11) is located, starting from the last recorded position of the tag (11).

7. The method according to claim 1 or 2, characterised in that, for said tag tracking, the radio frequency inquiry signals are sent towards the tags (11) through a spatial scanning of a space in which the tags (11) are located.

8. The method according to claim 6 or 7, characterised in that, during said spatial scanning, parameters characterising the response signals are recorded at the interrogating station, and phase conjugation is performed when a response signal is received at the interrogating station with parameters complying with the standards.

9. The method according to any preceding claim, characterised in that the inquiry signal is a high-power short pulse

10. The method according to claim 9, characterised in that the power of the phase conjugated signal transmitted back to the tags is progressively decreased at each iteration during the tag tracking.

11. An apparatus for reading passive tags (11) in a radio frequency identification system comprising an interrogating station sending radio-frequency inquiry signals towards the passive tags (11) and receiving from the tags (11) response signals each consisting of an inquiry signal reflected towards the interrogating station after having been associated with information carried by a respective tag, the interrogating station comprising a control unit (20) for controlling the transmission of the inquiry signals and for processing the response signals, characterised in that the interrogating station comprises an antenna array (10, 10a...10n), controlled by the control unit (20), and transmitting the inquiry signals and receiving the response signals, and in that the control unit (20) is arranged to detect and temporary store an absolute value and a phase of each response signal received at each antenna (10a...10n) of the array, and is connected with a phase conjugator (23) submitting each received signal to phase conjugation to generate respective phase-conjugated signal and supplying the phase conjugated signals to a radio frequency generator (24) connected to the antenna array, for back transmission of the phase conjugated signals to the passive tags (11).

12. The apparatus according to claim 11, characterised in that the phase conjugator (23) is arranged to amplify the signals to be transmitted back to the passive tags (11).

13. The apparatus according to any of claims 11 to 12, characterised in that the control unit (20) is adapted to control the radio frequency generator (24) and the antenna array (10, 10a...10n) in order to cause the emission of a wide angle lobed

signal forming the inquiry signal.

14. The apparatus according to any of claims 11 to 13, characterised in that, for said tag tracking, the control unit (20) is arranged, after the back transmission of a phase conjugated signal by the antenna array (10, 10a...10n), to receive a new response from the concerned tag (11), to correlate the new response with the previous one, and to iterate the operations of phase conjugation of the response signal, back-transmission of the phase conjugated signal, reception of a new response signal from a tag (11) and correlation of each new response signal with the previous one until the correlation reveals that the tag (11) has become stationary.

15. The apparatus according to claim 14, characterised in that said processing unit (20) is connected with a memory (21) in which, after detection of the stationary condition of a tag (11), the absolute value and the phase of the response signal denoting such condition are stored to mark a steady position of the tag (11), and in that said control unit (20) is arranged to control the phase conjugator (23) and the radio frequency generator (25) so as to periodically transmit back to the tag (11) the phase-conjugated signal relative to the stored position.

16. The apparatus according to claim 14 or 15, characterised in that, in case the phase-conjugated signal periodically transmitted back to a tag (11) fails to reach the tag (11), the control unit (20) is arranged to start a search for the tag through a spatial scanning of a space in which the tag (11) is located, starting from the last recorded position of the tag (11).

17. The apparatus according to claim 15 or 16, characterised in that said control unit (20) is arranged to resume the tag tracking whenever the tag response during the correlation reveals a position variation or when the tag (12) is found during the spatial scanning.

18. The apparatus according to claim 12 or 13, characterised in that, for said tag tracking, the control unit (20) is arranged to control the radio frequency generator (24) and the antenna array (10, 10a...10n) so as to effect a spatial scanning of a space in which the tags (11) are located.

19. The apparatus according to claim 16 or 18, characterised in that, during said spatial scanning, the control unit (20) is arranged to store parameters of the response signals from the individual tags (11) and to control the phase conjugator (23) so that phase conjugation is performed on the response signal received at the interrogating station with parameters complying the standards.

20. The apparatus according to any of claims 11 to 19, characterised in that the control unit (20) is arranged to control the radio frequency generator (24) and the antenna array (10, 10a...10n) in order to cause the emission of a short, high-power pulse forming the inquiry signal.

21. The apparatus according to claims 20, characterised in that the control unit (20) is arranged to progressively decrease, at each iteration of the tag tracking cycle, the emission power of the phase-conjugated signals.